6. Characteristic Oscillations of Sheet Plasma

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6. Characteristic Oscillations of Sheet Plasma

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The characteristic oscillations of a plasma with steep density gradient are studied numerically. Plasma is assumed to be collisionless and is uniform in the y-z plane with a Gaussian density profile in the x-direction. The half width λ of the plasma is of the order of ion Larmor radius ρ_i. Such a plasma is called the sheet plasma. The Landau and cyclotron damping as well as the finite Larmor radius effects play an important role for the characteristic oscillations of the sheet plasma. To analyze the characteristic oscillations, an integral equation in wavenumber space is derived by using the Vlasov and Poisson equations. This equation is solved numerically. Frequency of eigenmode is assumed to be of the order of ion cyclotron frequency. The eigenmodes corresponding to the ion Bernstein wave ($k_{/\!/}=0$; $k_{/\!/}$ is the wavenumber along the lines of force) and electrostatic ion cyclotron wave ($k_{/\!/}$=finite) are calculated. When the width of the sheet plasma is large (for example $\lambda=5\rho_i$), it is found that the eigenfrequency can be well approximated from the dispersion relation of the uniform plasma. These modes are strongly affected by finite ion Larmor radius effects. For an ideal sheet plasma ($\lambda=\rho_i$), it is found that the fundamental mode is little affected by the finite ion Larmor radius effects and the eigenfrequency can be approximated by $\omega=\omega_{ci}\sqrt{1+T_e/T_i}$ for finite $k_{/\!/}$ mode. The damping rate of this mode is rather small.

7. 軸対称トーラスプラズマにおけるMHD不安定性に関する二次元固有値問題の数値解法

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軸対称トーラスプラズマのMHD 不安定性の解析には二次元の固有値問題を解く必要がある。この二次元固有値問題を解く新しい手法を開発した。

磁場閉じ込めによる核融合装置においては，プラズマの圧力の磁場の圧力に対する比β値を高くすることが重要な研究課題になっている。β値を高くすると磁力線の曲率の悪い領域に磁